

INDOOR AIR QUALITY ASSESSMENT

**Middlesex County Courthouse Tower
40 Thorndike Street
Cambridge, Massachusetts**



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Introduction

In response to a request from the Honorable Roanne Sragow, an indoor air quality assessment was done at the Middlesex County Courthouse Tower (MCCT), 40 Thorndike Street, Cambridge, Massachusetts. This assessment was conducted by the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA). Long-standing complaints from employees of headaches, fatigue and drowsiness (noted in previous reports by MDPH and others) were reiterated during this current evaluation.

Since October 2000, a series of visits were made to this building by staff of the Emergency Response/Indoor Air Quality (ER/IAQ) Program: Michael Feeney, Chief, Cory Holmes and Suzan Donahue. Accompanying BEHA staff during these assessments was Rosa Chavez, the building supervisor of the East Cambridge Court Campus. The series of visits during 2000-2001 provided the opportunity for BEHA staff to evaluate the MCCT in its entirety. A final visit was made by Mr. Feeney on January 8, 2002 to assess actions taken in response to recommendations made concerning the Middlesex County Sheriff's Office and the 16th floor mechanical room. Previously, BEHA had assessed various floors of the MCCT based on isolated requests by either building occupants or building maintenance staff.

This report serves as both an evaluation of current indoor conditions as well as of remedial actions taken by building staff in response to the various BEHA indoor air quality assessment recommendations. General recommendations that apply building wide, as well as those that apply to the three sections of the building, are made in this report.

Building Description

The MCCT is a twenty-story skyscraper located in a city block formed by Thorndike Street, Second Street, Third Street and Spring Street in the Lechmere section of East Cambridge. Unlike previous assessments, this series of visits evaluated all floors of the building, including the elevator mechanical rooms, roof, basement and sub-basement levels. The building can be divided into three distinct sections based on the design of the ventilation system and the use of the space. The jail contains the Middlesex County Sheriff's Office and Prisoner Holding Area (floors 16 to 20). The court tower includes the Cambridge District Court, the Cambridge Superior Court and the law library (floors 5 through 15). Floors 1 through 4 of the low rise contain the District Attorney's Office, Grand Jury rooms, cafeteria, Registry of Deeds, clinic, day care center, Presiding Judge's office, maintenance offices, main lobby and judge's parking garage. The basement contains the rear entrance, loading dock and parking garages. The sub-basement contains the mechanical rooms for the low-rise ventilation system and the heat/electrical utility room. Linking all three sections of the building are the steam heat pumps located in the sub-basement of the building and elevator shafts (11 total). The building does not have openable windows, with the exception of offices in the Middlesex County Sheriff's Office (see Appendix I). Windows are single paned and have tinting to reduce solar glare (NIOSH, 1990).

As noted in the indoor air quality assessment MDPH previously conducted at the Cambridge District Court, four indoor parking garages and one loading dock exist in the basement level and first floor of the building (MDPH, 1999). This report contained a

complete description of the pathways for vehicle exhaust to penetrate into the interior of the tower, and is included as Appendix II.

Middlesex County Sheriff's Office and Prisoner Holding-Floors 16 – 20

In December 2000, the Middlesex County Sheriff's Office (MCSO) and lock up facilities on the 17th through 20th floors of the Middlesex County Courthouse Tower (MCCT) were evaluated. The MCSO is a secure facility that consists of two clusters of offices on the east and west sides of the floor. Each office cluster is separated by the waiting room and the lock up system control room in the center of the floor. Electronically operated doors control entrance into employee areas. Unlike other floors in the building, a number of exterior offices have openable jalousie (louvered) windows. The infirmary and isolation segregation areas are located on the 17th floor. Inmates are confined on the 18th – 20th floors. A cafeteria, kitchen and the chapel are located on the 19th floor.

The Court Tower-The Cambridge District Court, Cambridge Superior Court And Law Library-Floors 5 Through 15

The court tower consists of courtrooms, office space, ventilation system mechanical rooms and other support areas related to the operation of the Cambridge District Court and Cambridge Superior Court. In addition, the jury pool room and drug analysis lab for the Middlesex County Jail system exist in the court tower. Floors 5 and 6 contain the law library.

The Base Building Section-Floors 1 Through 4, Basement and Sub-basement

Floors 1 through 4 contain the cafeteria, District Attorney's Office, clinic, daycare center, building maintenance offices, presiding judge's chamber and front lobby. Also on the first floor is an indoor parking garage. The basement contains two indoor parking garages, a loading dock, prisoner off-loading area and the upper story of the mechanical electrical/steam room. The sub-basement contains the lower story of the mechanical electrical/steam room and two mechanical rooms contain the base building's ventilation systems.

Previous Assessments Conducted by Other Agencies/Organizations

This building had been evaluated by a number of agencies, prior to the BEHA assessment, over the course of the past ten years due to concerns about asbestos. Numerous air tests have been conducted, the most recent in the summer of 1998 (Yee Consulting, 1998). The National Institute for Occupational Safety and Health (NIOSH) conducted evaluations on August 8, 1989 and May 2, 1990. NIOSH concluded that (1) the thermostats in the building needed re-calibration, (2) more fresh air should be introduced through the HVAC system, (3) cleaning to reduce environmental dust should be enhanced and (4) efforts should be made to limit smoking (NIOSH, 1990). The Massachusetts Department of Labor and Workforce Development (MDLWD) conducted an evaluation on January 22 & 24, 1997. In addition to the NIOSH recommendations, MDLWD recommended (1) servicing of the ventilation system, (2) taking measures to prevent vehicle exhaust movement into the building, (3) increasing HVAC filter changes, and (4) replacing water damaged materials and disinfecting

suspected mold growth (MDLWD, 1997). In addition to these reports, several notices were posted concerning the ban on smoking in public buildings. Both Cambridge City Ordinance (Middlesex Superintendent, 1989) and declaration by the Middlesex County Commissioners (Middlesex Superintendent, 1996) ban smoking in public buildings in Cambridge, MA.

Actions on Recommendations Previously Made by MDPH

BEHA has made recommendations in each of its reports to improve indoor air quality in various sections of the MCCT. Building maintenance staff have reportedly acted on the recommendations that are within their control. The following is a status report of action(s) on BEHA recommendations based on reports from building staff, documents, photographs and BEHA staff observations.

Cambridge District Court (MDPH, 1999a)

- 1. Close all doors to the steam machinery room, HVAC system rooms, stairwell doors, interior indoor parking garage doors and the door to the loading dock to minimize airflow from the basement to other areas in the building.**

Action Taken: With the exception of the loading dock door opposite the elevators on the basement level, BEHA staff found all doorways to these areas closed. Each of these doors was posted with a sign instructing occupants to keep door closed (see Picture 1).

2. Consider installing flashing around all doors that lead from parking garages to the interior of the building.

Action Taken: The door to the judge's indoor parking garage was sealed with flashing to prevent air movement. Operators in the parking garage were instructed to open the exterior garage door prior to starting vehicles. During one of the October 2001 visits by BEHA staff, individuals using the parking lot did not adhere to this policy.

3. Seal utility holes in walls of all indoor parking garages.

Action Taken: Utility holes in indoor garages were sealed with a spray caulking material (see Picture 2). In order to assess whether containment measures were effective to prevent pollutant movement from the first floor parking garage into occupied areas of the MCCT, air monitoring for carbon monoxide and ultrafine particles was conducted around each interior door as well as within the parking garage while vehicles were leaving. The combustion of gasoline can produce carbon monoxide and particulate matter that is of a small diameter [10 microns (μ)] and can penetrate into the lungs to cause irritation. For this reason a device that can measure 10 μ or less particles was used to identify pollutant pathways from the parking garage into occupied areas. No detectable levels of carbon monoxide were measured around hallway doors adjacent to the parking garage. However, ultrafine particles (over background levels taken in the stairwell of the central staircase) were noted emanating through seams and holes around the parking lot doors (see Picture 3). The presence of these particles doesn't suggest health risks but does indicate

that an air pathway continues to exist from the first floor parking garage into the interior of the MCCT.

4. Reduce or eliminate plants from the clerk's office.

Action Taken: BEHA staff noted that plants were removed from the clerk's office.

5. Discontinue the use of pesticides in the clerk's office.

Action Taken: A memorandum instructing the discontinuance of pesticide use was circulated to the MCCT staff.

6. Seal or remove fiberglass from beneath the clerk's office kitchen refrigerator.

Action Taken: Refrigerator was replaced (AOTC, 1999).

7. Discontinue the use of burning candles in offices.

Action Taken: A memorandum instructing the discontinuance of candle burning was circulated to the MCCT staff.

8. Enforce the no smoking policy in court areas in a manner consistent with state and local law.

Action Taken: A memorandum instructing the discontinuance of smoking was circulated to the MCCT staff. Cigarette butts were noted in a number of areas on nearly all visits to the building. The most frequent location of cigarette butts was the central stairwell that leads to the MCSO.

9. Consider moving furniture away from fan coil units to better control perceived temperature extremes.

Action Taken: BEHA staff observed that this recommendation was not acted upon

10. Replace water damaged ceiling tiles.

Action Taken: The facility's management staff report that ceiling tiles are regularly replaced when reported by floor occupants.

11. Wet the shower drain in the clerk magistrate's restroom to wet the trap and prevent sewer gas odor penetration.

Action Taken: The facility's management staff reports that water is routinely poured into drains to maintain the water seal of drain traps.

12. Health and building complaints are consistent with what might be encountered in a dry, dusty environment. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, continue scrupulous cleaning practices to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

Action Taken: The facility's management staff has improved cleaning practices throughout the building since the issuance of the report of March 1999. Ceiling tiles and fresh air diffusers were cleaned of accumulations previously noted.

- 13. Consider the installation of mechanical exhaust ventilation to vent vehicle exhaust outdoors. These systems should create negative pressure to prevent vehicle exhaust penetration into the building interior.**

Action Taken: No exhaust vent for parking garages was installed. Doors leading from garages were sealed with weather stripping.

- 14. Ascertain the purpose of the supply vent in the steam mechanical room.**

Action Taken: Building staff report that the steam system was repaired. The purpose of this vent is still undetermined.

- 15. Consider replacing air diffusers in courtrooms with ones that are designed to direct cold air away from jurors. If not possible, consider rearranging the configuration of these courtrooms to move seated individuals out from underneath air diffusers.**

Action Taken: Fresh air diffusers remain in place.

Grand Jury Room And Adjacent Offices (The Grand Jury Area)-3rd Floor Recommendations (MDPH, 2000b)

- 1. Seal all wall holes permanently with spackle. Seal all wall seams around the induction units with an appropriate seam sealing compound.**

Action Taken: Wall holes and seams were sealed.

- 2. As a temporary measure to prevent total volatile organic compound (TVOC) movement into the grand jury administration office seal electrical outlets to serve as a TVOC barrier.**

Action Taken: Electrical outlets were sealed.

- 3. Once the grand jury area is sealed, employ exhaust ventilation to dry the ceiling tiles. Since the building does not have openable windows, exhaust ventilation has to be directed into the interior of the building. If this is done, exhaust ventilation should only be done after business hours, preferably on the weekend when there are minimal amounts of employees in the building. Please note that exhaust ventilation may not succeed in reducing odors, since moisture is sealed within the tiles.**

Action Taken: Examination after the initial assessment found no unusual levels of TVOCs within the grand jury room, indicating that the ceiling tiles had dried.

14th Floor Holding Cells Control Room Areas-14th Floor (MDPH, 1999c)

- 1. Repair the exhaust vents in the break room and rest room.**

Action Taken: Trial court staff report that these exhaust vents were repaired (AOTCCFB, 1999).

- 2. Discontinue spray painting of prisoner shackles in the break room.**

Spray paint and drying spray painted materials should only be conducted in an area where VOCs cannot be entrained by the AHU, and has adequate local exhaust ventilation. If no adequate area for spray painting exists indoors, conduct this activity outdoors.

Action Taken: Trial court staff recommended to the Middlesex Superior Court Chief Court Officer to discontinue spray painting indoors (AOTCCFB, 1999).

- 3. Consider discontinuing the use of ozone generators in the building. If use is continued, adequate ventilation should be utilized to prevent the build up of ozone within offices.**

Action Taken: Trial court staff recommended to the Middlesex Superior Court Chief Court Officer to discontinue the use of ozone generators (AOTCCFB, 1999).

Middlesex County Sheriff's Office (MCSO)-17th Floor

- 1. Identify the source of water damaging the ceiling in the waiting room and repair. Once the leak is repaired, examine nonporous surfaces above the ceiling and disinfect with an appropriate antimicrobial.**

Action Taken: Ceiling plaster in the waiting room was repaired.

- 2. Repair the exhaust vents in the rest room.**

Action Taken: The restroom exhaust ventilation system was operating.

- 3. Remove insulation from the air diffuser in the superintendent's outer office. Consider rearranging the configuration of the superintendent's outer office to move seated individuals out from underneath air diffusers.**

Action Taken: Insulation was removed from air difusers.

- 4. Remove stored supplies from the mechanical room on the 16th floor to prevent odors from these materials from being entrained by the HVAC system. Store flammable materials in a flammables storage cabinet that meets the specifications of the NFPA (NFPA, 1996).**

Action Taken: All paints and flammable materials were removed from the 16th floor mechanical room.

- 5. Consider moving the fan, noted in the sheriff's reception office, to a wall not immediately adjacent to the photocopier.**

Action Taken: This fan remains in place. BEHA staff recommends deactivating this fan during photocopier operation.

- 6. Consider discontinuing the use of ozone generators in the building. If use is continued, adequate ventilation should be utilized to prevent the build up of ozone within offices.**

Action Taken: Ozone generators were removed.

Reassessment

Methods

Air tests for carbon monoxide, carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551. Air tests for carbon monoxide were taken with the TSI, Q-Trak TM, IAQ Monitor Model 8551. Air tests for ultrafine particulates were taken with the TSI, P-Trak TM Ultrafine Particle Counter Model 8525.

Results

The MCCT has approximately 1000 employees and is visited daily by approximately one hundred individuals. The tests were taken under normal operating conditions. Test results appear in Tables 1-23.

Discussion

Building-Wide Conditions

As indicated in the Cambridge District Court IAQ assessment (MDPH, 1999), a number of conditions were noted within the floors evaluated that indicate a combustion source is penetrating into this building and effecting the upper floors of the tower. Measures were taken to prevent vehicle exhaust migration from parking garages into stairwells and the west judge's elevator shaft.

In order to assess whether containment measures for parking garages were effective to prevent pollutant movement from parking areas into occupied areas of the building, air monitoring for carbon monoxide and ultrafine particles was conducted on both sides of the doorframe of the stairwell entrance for the judge's parking lot. Air monitoring for carbon monoxide and ultrafine particles was also conducted in the mechanical rooms that top each elevator shaft. The combustion of fossil fuels can produce particulate matter that is of a small diameter [10 microns (μ)] and can therefore penetrate into the lungs to cause irritation. For this reason a device that can measure 10 μ or less particles was used to identify pollutant pathways.

Detectable levels [4 parts per million (ppm)] of carbon monoxide were measured in the mechanical room that tops the judge's elevator in the west side of the

building (see Tables 24 and 25). In addition, ultrafine particles were detected around spaces adjacent to the judge's parking lot doorframe. The installation of electrical outlets and light switches (see Picture 4) along walls in the parking lots provides pathways for vehicle pollutants to migrate into the interior of the MCCT. Once inside the building, vehicle generated pollutants can move to other sections of the tower by elevator shafts and stairwells.

Based on these observations, all seams along doorframes and electrical outlets around parking garages should be rendered airtight to reduce pollutant penetration. Sealing of wall areas may provide a barrier to reduce pollutant migration from indoor parking lots. The addition of local exhaust ventilation for the indoor parking garages would serve to remove vehicle exhaust directly from the building. It is highly recommended that the feasibility of installing mechanical exhaust ventilation be determined for each indoor parking area and loading docks by a ventilation engineer.

Dust deposition around ceiling fresh air diffusers (see Picture 5) was observed in a number of areas. Soot from vehicle exhaust related to indoor parking garages was initially identified as a possible source of this deposition (MDPH, 1998). Several conditions indicated that filtered outside air may also be a contributing source of the deposition. A survey of fresh air intake conditions was conducted on floors 7 through 14 (see Table 26). Filters had spaces between/around the frame and the installation rack, which can allow unfiltered air to penetrate into the air-handling unit (AHU) (see Pictures 6 through 8). Access doors to some AHUs were blocked with pipe installations, making filter change impossible (see Picture 9). On these floors, filters may be missing or saturated with other debris. Both of these conditions can allow

outdoor airborne particulates to penetrate into the AHU and be distributed into the building. Building staff reported that routine changing of AHU filters had begun within the year prior to this current round of BEHA indoor air quality assessments.

Another building wide problem that was evident during all visits to the MCCT is smoking within the building (see Picture 10). Although smoking is banned in this state office building by local city ordinance (Middlesex Superintendent, 1989) and state law (Middlesex Superintendent, 1996), signs of cigarette smoking were observed in several areas, particularly in the central stairwell that leads to the MCSO. Tobacco smoke odors and cigarette butts in a coffee cup were also noted by BEHA staff on the sixth floor in the vicinity of the 6-9 storeroom.

Environmental tobacco smoke can have a marked effect on indoor air quality. Environmental tobacco smoke is an indoor air pollutant, and a respiratory irritant that can exacerbate the frequency and severity of symptoms in asthmatics. The most effective method of preventing exposure to environmental tobacco smoke is to have smoke free buildings. M.G.L. Chapter 270, Sec. 22 prohibits smoking in public buildings, except in an area which has been specifically designed as a smoking area (M.G.L., 1987). The American Society of Heating, Refrigeration, Air-Conditioning Engineers (ASHRAE) recommends a ventilation rate of 60 cubic feet per minute per occupant in smoking lounges (ASHRAE, 1989). The ASHRAE recommendation is designed to prevent cigarette smoke odors from penetrating areas outside the designated smoking area. Smoking in this facility should not occur outside of this designate area.

Ventilation

It can be seen from the tables that carbon dioxide levels were below 800 parts per million parts of air [ppm] in all but three areas sampled in the MCC (one in the MCC proper and two in the MCSO). These carbon dioxide levels are indicative of an adequate fresh air supply in most areas of the building. It should be noted however that several areas had low occupancy and/or open windows, which can greatly contribute to reduced carbon dioxide levels. The ventilation system within the MCCT is configured into three separate designs:

MCSO HVAC System

The MCSO, located above the 16th floor, is provided with ventilation by a combination of rooftop air handling units (AHU) and an AHU located in the 16th floor. Fresh air is supplied by ceiling mounted air diffusers. These diffuser vents on the 18th floor dormitory were found blocked with tissue paper. Vents must remain clear in order to function as designed. Exhaust ventilation is provided by ducted, return air vents that are connected to an air-handling unit. General exhaust vents were operating during this evaluation. These vents must also remain unblocked in order to function as designed. Several exhaust vents in the shower area on the 18th floor were not drawing air. Exhaust ventilation is necessary in order to remove moisture and to prevent odors from migrating into adjacent areas. The location and condition of the 16th floor AHU is described in Appendix I.

MCCT Tower HVAC System

Each floor of the core section of the building (floors 5 through 15) is serviced by two AHUs located on each floor. Each AHU services one half of each floor, with the elevator lobby as the dividing line. Fresh air is drawn into each AHU through an intake vent at the level of the AHU (see Picture 11). Fresh air is distributed to hallways and large internal office space by ceiling mounted air diffusers. Private offices and other spaces along the exterior perimeter of each floor are also equipped with induction units to increase airflow and provide heat (see Picture 12). Exhaust ventilation is provided by ceiling mounted air intakes that are connected to the AHU by ductwork. A percent of return air is exhausted from the building by exhaust vents that are also located at the level of each AHU room. Hallways do not have ducted exhaust vents. Each AHU has a passive, louvered door vent (Picture 13). Air from the hallway is drawn through the passive vent by a fan (see Figure 1), located in the side of the AHU exhaust vent ducts (see Picture 14). Each AHU room thus serves as an exhaust ventilation plenum to draw air from hallways. With these door vents closed, the draw of exhaust air is minimized. This can result in increased temperature and discomfort for individuals congregating in hallways for extended periods of time.

MCCT Low-rise HVAC System

Floors located below the library levels are supplied with fresh air from AHUs located in the sub-basement. Fresh air is drawn into these AHUs through subterranean pits that flank the east and west sides of the building (see Picture 15). Exhaust ventilation is also expelled through these vents. The low-rise fresh air intake vents in

subterranean pits are prone to accumulation and blockage by accumulated trash and outdoor debris (see Picture 16). Maintenance staff are required to routinely clean accumulated debris from these vents.

All areas examined in the building had operating fresh air supply and exhaust ventilation systems throughout the assessments, as confirmed by the carbon dioxide levels measured in this building. To maintain proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air. The date of the last servicing and balancing of these systems was not available at the time of the visit. It is recommended that HVAC systems be rebalanced every five years to ensure adequate air systems function (SMACNA, 1994).

The Massachusetts Building Code requires a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room for offices and cells (15 for guard stations) (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health

Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches.

Temperature readings were within a range of 66° to 79° F, which were close to the BEHA recommended comfort range in most areas. The BEHA recommends that indoor air temperatures be maintained in a range of 70° to 78° F in order to provide for the comfort of building occupants. While temperature readings outside the recommended range are generally not a health concern, increased temperature can affect the relative humidity in a building.

Unlike the lower floors of this building, a number of areas in the MCSO have openable windows. Reports of cold temperatures in these offices in the winter can be attributed to the window design. The louvered-style windows consist of a number of overlapping glass panes that can be opened at an angle using a crank system. Because they are openable, these windows do not provide an airtight seal to prevent outdoor air penetration. As a stop-gap measure, sheets of plexiglass are reportedly installed over these windows during winter months. A number of complaints of uneven heating and cooling were also reported throughout the building (see Tables). In many cases

concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

Relative humidity measurements ranged from 16 to 37 percent, which was below the recommended BEHA comfort guideline in all areas surveyed. The BEHA recommends that indoor air relative humidity is comfortable in a range of 40 to 60 percent. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

A number of rooms have water-damaged walls and ceiling tiles which can indicate leaks from the plumbing system and/or windows. A number of areas in the MCSO are reported by building occupants to have active leaks (see Tables). These floors (floors 17 - 20) have a history of water damaged building materials due to plumbing failure of commodes and sinks located in patient cells. Reportedly, occupants intentionally tamper with these fixtures. This results in flooding and subsequent damage. Water-damaged ceiling tiles and other porous materials (e.g., carpeting, wallboard) can provide a medium for mold and mildew growth and should be replaced after a water leak is discovered. Active mold growth was observed in the 3rd floor juvenile court.

Several offices contained a number of plants. Plant soil and drip pans can provide a source of mold growth. Several planters were colonized by mold. Over-watering of plants should be avoided and drip pans should be inspected periodically for

mold growth. Plants should have drip pans to prevent wetting and subsequent mold colonization of window frames. Plants should also be located away from ventilation sources to prevent the aerosolization of mold, dirt and pollen.

The cafeteria also contains several planters. All of these planters are devoid of living plants but are filled with dirt (see Picture 17). It could not be determined whether any of these planters have adequate drainage. Plant soil can be a source of particulates (such as mold), which can be a respiratory irritant to some individuals if aerosolized. Planters should be properly maintained and have adequate drainage.

Some areas had water coolers on carpets. Water spillage or overflow of cooler catch basins can result in the wetting of the carpet. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that carpeting be dried with fans and heating within 24 hours of becoming wet (ACGIH, 1989). If carpets are not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed.

The sheriff's office reception area contained a humidifier. Humidifiers collect water, which can become stagnant and provide a medium for bacterial and mold growth as well as a source of unpleasant odors.

As stated previously, many of the windows have been damaged and/or do not close properly. Repairs of window leaks are necessary to prevent further water penetration. Repeated water damage can result in mold colonization of window frames, curtains and items stored on or near windowsills.

Other Concerns

Several other conditions that can potentially affect indoor air quality were also identified. A number of areas had missing ceiling tiles and/or open utility holes. Missing ceiling tiles and utility holes can provide an egress for dirt, dust, odors and particulate matter between rooms and floors. These materials can be irritating for certain individuals.

Fiberglass insulation inside many AHUs was abraded, torn or otherwise damaged (see Pictures 18 and 19). The condition of damaged fiberglass insulation inside AHUs coupled with the air movement provides the opportunity for airborne particulates to penetrate into occupied areas. Aerosolized dust, particulates and fiberglass can provide a source of eye, skin and respiratory irritation to certain individuals. In addition, these materials can accumulate on flat surfaces (e.g. desktops, shelving, carpets, etc.) below these areas and subsequently be re-aerosolized causing further irritation.

Several rooms contained dry erase boards and dry erase markers. Materials such as dry erase markers and dry erase board cleaners may contain VOCs, (e.g., methyl isobutyl ketone, n-butyl acetate and butyl-cellusolve) (Sanford, 1999), which can be irritating to the eyes, nose and throat.

Also of note was the amount of materials stored in some areas. In both offices and cubicle areas, items were seen piled on windowsills, tabletops, counters, bookcases and desks. The large amount of items stored provides a means for dusts, dirt and other potential respiratory irritants to accumulate. These stored items, (e.g., papers, folders,

boxes, etc.) make it difficult for custodial staff to clean. Dust can be irritating to the eyes, nose and respiratory tract.

Odors from air fresheners and scented candles were noted in several areas (see Tables). These products may contain chemicals that can be irritating to the eyes, nose and throat of sensitive individuals. In addition, air fresheners do not remove materials causing odors, but rather mask odors which may be present in the area.

Accumulated chalk dust was noted in the adult probation office (15-54) and in the clerk's office on the 6th floor. Chalk dust is a fine particulate that can be easily aerosolized, becoming an eye and respiratory irritant.

The 5th floor corrections area contains a number of pieces of office equipment (photocopiers, printers, etc.) and a drug/alcohol-screening laboratory. Volatile organic compounds (VOCs) and ozone can be produced by photocopiers, particularly if the equipment is older and in frequent use. Ozone is a respiratory irritant (Schmidt Etkin, D., 1992). Photocopiers and computer/laboratory equipment also give off excess heat. Strong urine odors were noted in the laboratory and surrounding areas. A number of different vents were seen in the area, however laboratory personnel were unable to describe the function of each to BEHA staff.

Conclusions/Recommendations

In view of the findings at the time of the visit, the following recommendations are made:

1. Consideration should be given to installing mechanical exhaust ventilation systems for each indoor parking garage area to remove vehicle exhaust from the interior of the building.
2. The interior of AHUs that have an inaccessible filter access door should be examined. To gain access, reconfiguration of pipes in these AHU rooms may be necessary (see Tables).
3. Torn and/or damaged fiberglass insulation on AHUs should be repaired or replaced.
4. All AHUs should be installed with adequate air filters that are routinely replaced consistent with manufacturer's recommendation.
5. To reduce the amount of debris that accumulates and blocks fresh air intake vents in the low-rise HVAC system, consideration should be given to constructing an air baffle system that would trap debris without hindering airflow into these vents (see Figure 2). Consideration should be given to consulting a building engineer to determine viable options that can be used to prevent debris accumulation.
6. Implement recommendations in previous BEHA correspondence.
7. Restore airflow through AHU passive vent doors to increase exhaust ventilation in hallways.
8. Remove planters from cafeteria.

9. Identify the source of plumbing leaks damaging ceiling tiles and repair.
Once leaks are repaired, examine nonporous surfaces above the ceiling and disinfect with an appropriate antimicrobial.
10. Repair exhaust vents in the shower room on the 18th floor.
11. Remove tissue paper from the air diffusers in the 18th floor dormitory.
12. Consider contacting an industrial hygienist or HVAC engineering firm specializing in laboratory ventilation to evaluate HVAC components in the 5th floor lab area (community corrections) to ensure proper airflow and removal of odors associated with the urine sampling machine/lab equipment.
13. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all non-porous surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
14. Move plants away from air diffusers and ensure drip pans are placed underneath plants. Examine plants for mold growth in water catch basins. Disinfect water catch basins if necessary.

15. Clean humidifiers and dehumidifiers regularly and maintain as per the manufacturer's instructions to prevent microbial growth and/or unpleasant odors.
16. Replace missing ceiling tiles and fill utility holes to prevent the egress of dirt, dust, odors and particulate matter between rooms and floors.
17. Examine the feasibility of repairing/replacing windows in the MCSO where drafts/water penetration has been reported.
18. Prohibit smoking in this building in accordance with Massachusetts law (M.G.L. Chapter 270, Sec. 22).
19. Relocate or consider reducing the amount of stored materials to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.
20. Clean chalkboards and trays regularly to prevent the build-up of excessive chalk dust.
21. Refrain from using strong scented materials in common work areas and restrooms.

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NIOSH. 1990. Letter to John Buonomo, County Administrator from Edward Kaiser, Regional Industrial Hygienist, NIOSH, Concerning Indoor Air Quality and Asbestos, dated October 24, 1990. National Institute for Occupational Health and Safety, Region 1, Boston, MA. HETA 89-238.

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Figure 1

AHU Room Configuration for Exhaust Ventilation

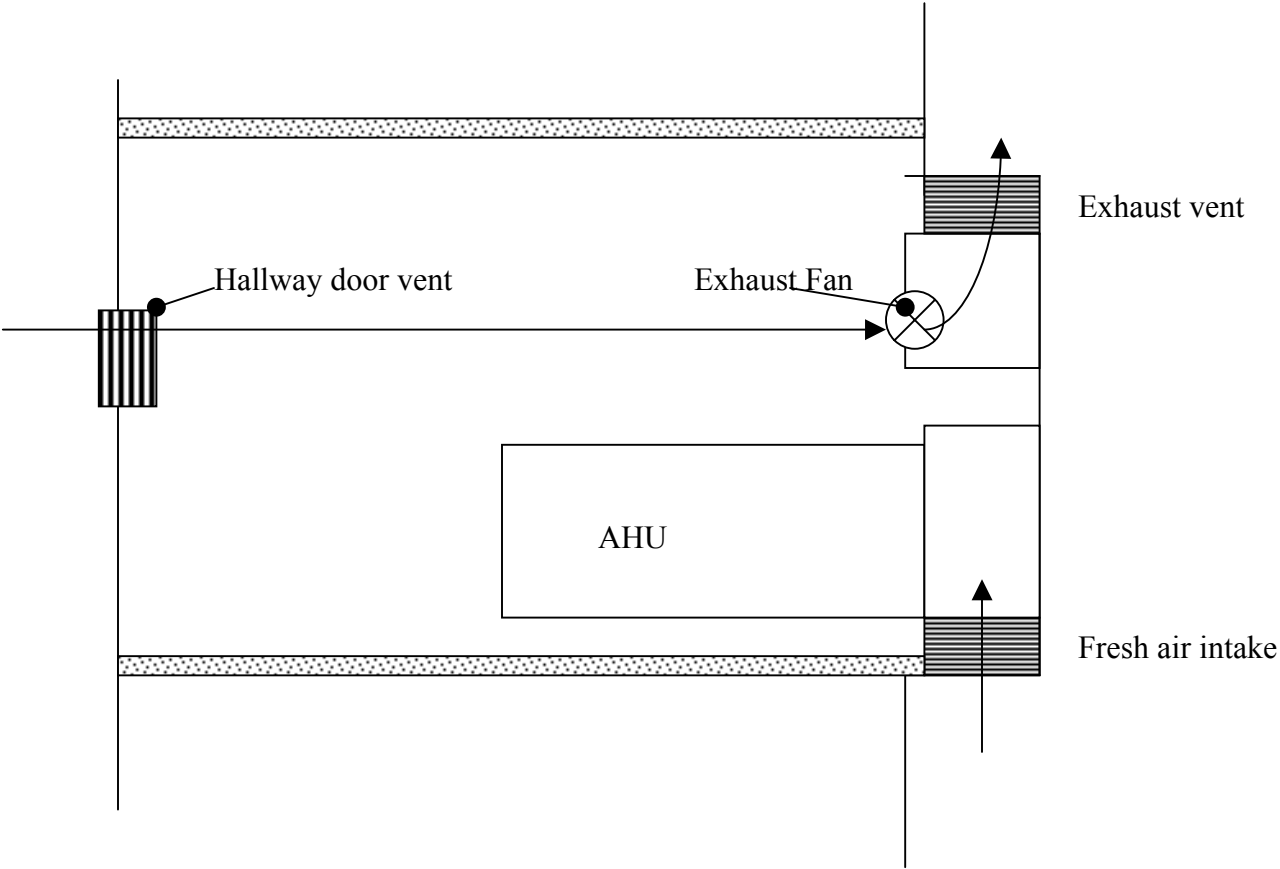
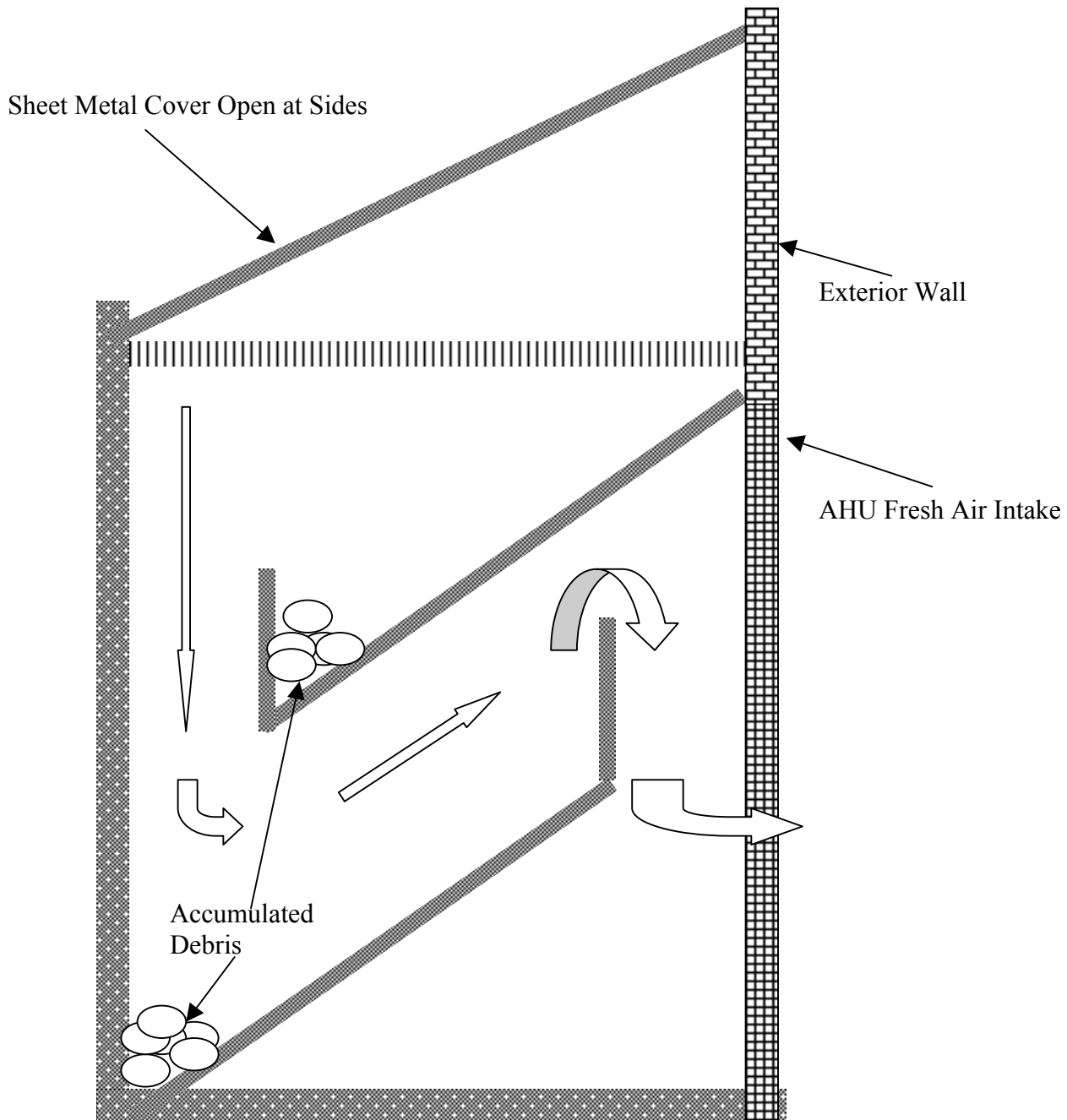

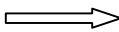


Figure 2 Possible Air Baffle System for Subterranean Fresh Air Intakes



Key

-  Sheet Metal
-  Fresh Air Pathway

Drawing Not to Scale

Picture 1



Stairwell Door Leading To First Floor Parking Lot, Note Posted Sign

Picture 2



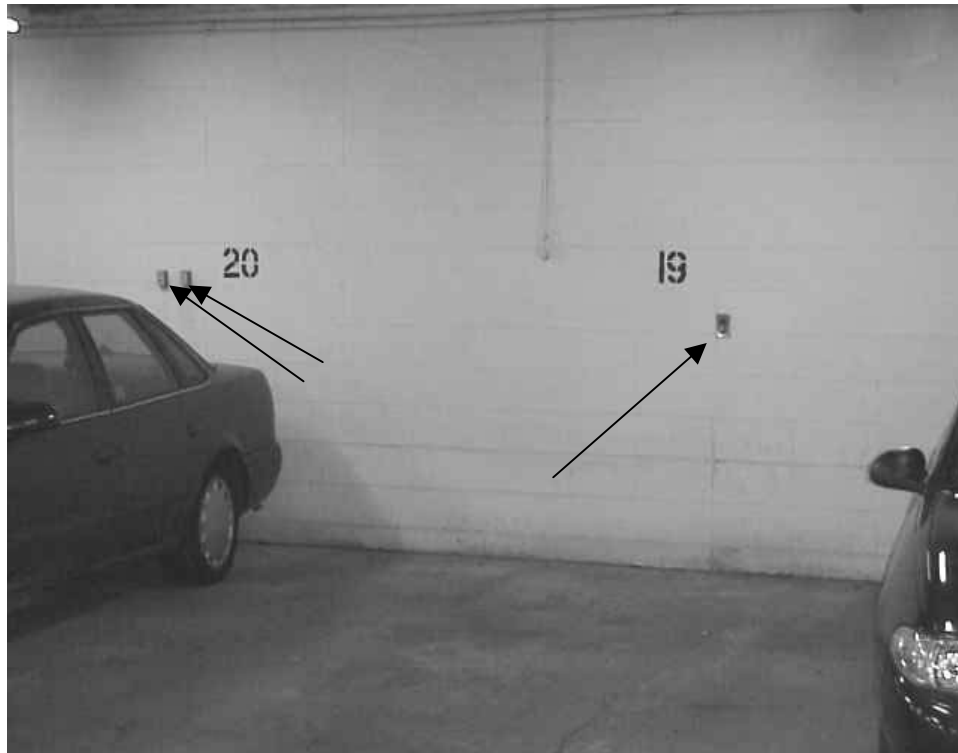
Sealed Pipe/Ceiling Junction with Spray Foam Sealant

Picture 3



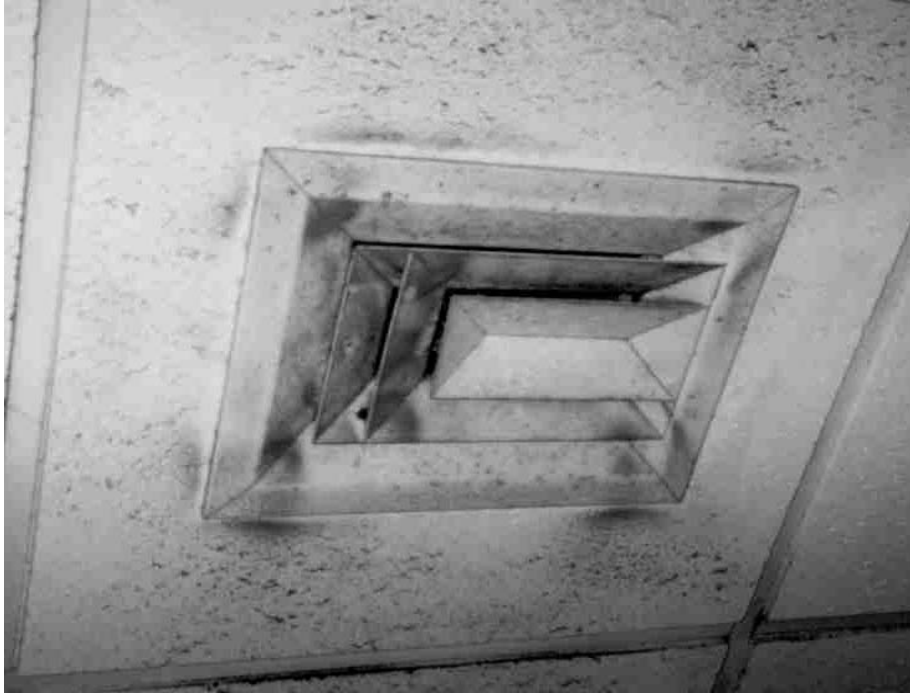
Hole In Parking Garage Doorframe Serving as Air Pathway

Picture 4



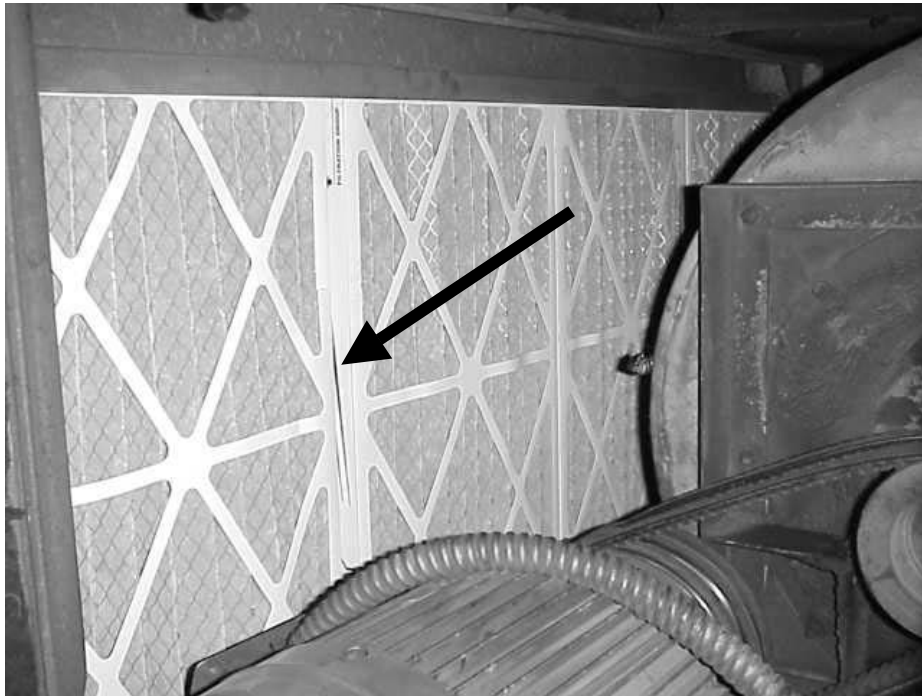
Wall Electrical Outlets and Thermostats in Parking Garages.

Picture 5



Example of Heavy Particle Deposition around Fresh Air Supply Vent Prior To Cleaning Efforts by MCCT Staff

Picture 6



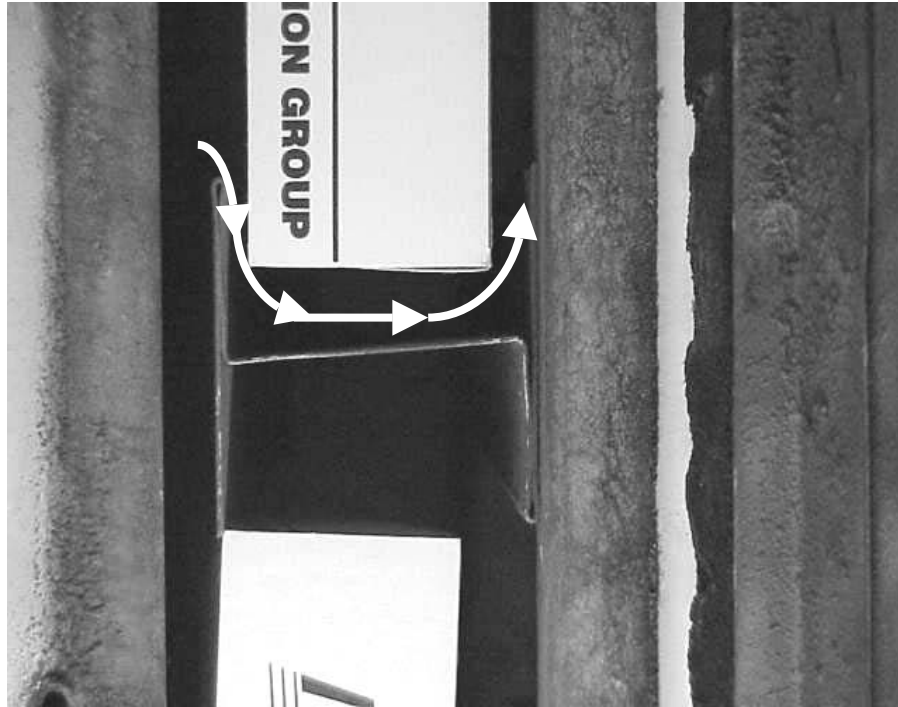
Spaces Between Filters in AHU

Picture 7



Spaces Between Filters in AHU

Picture 8



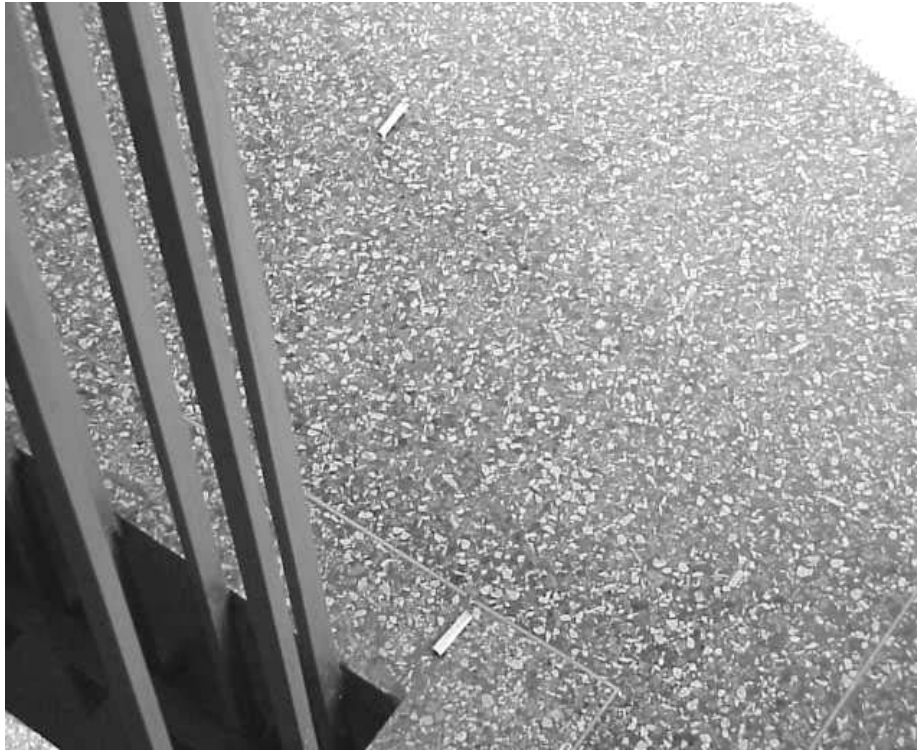
Spaces Between Installed Filters, Arrows Denote Airflow Bypass Path of Filters

Picture 9



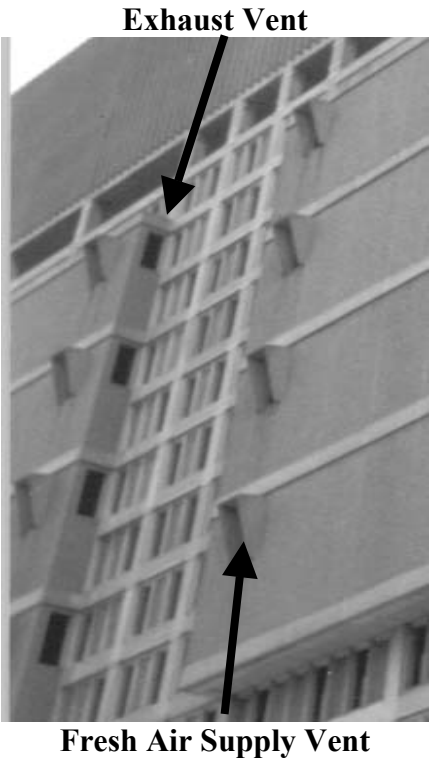
Access To This AHU Blocked by Pipe Installation

Picture 10



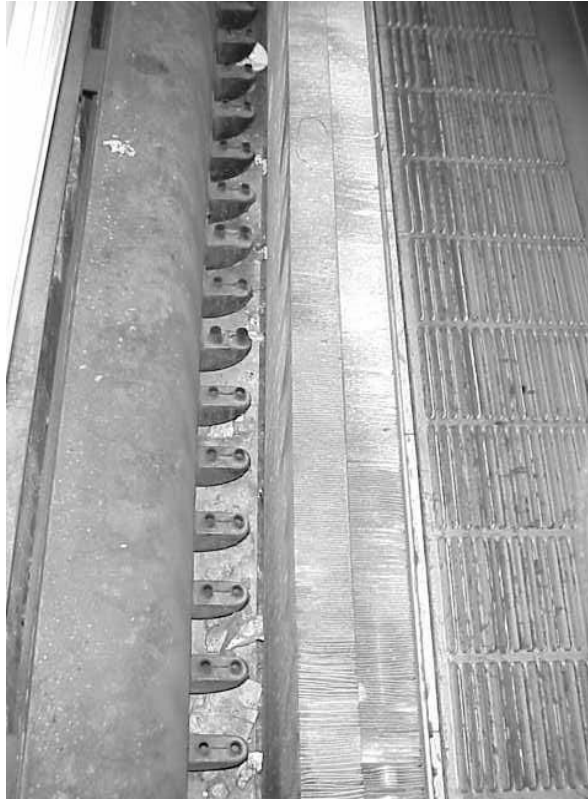
Cigarette Butts On Floor of Central Stairwell

Picture 11



Fresh Air Intakes and Exhaust Vents for Floors 7 through 15

Picture 12



Induction Unit Located Beneath Window of Private Office

Picture 13



Passive Door Vent Located In AHU Room Door

Picture 14



Operating AHU Room Exhaust Fan In General Exhaust System Duct

Picture 15



Fresh Air Intakes for the Low-Rise Section in the East Wall of the MCCT

Picture 16



**Accumulation of Materials On Top Of Fresh Air Intake Vent for the Low-Rise
Section In the West Wall of the MCCT**

Picture 17



Planters Filled With Dirt in the Cafeteria

Picture 18



Damaged Fiberglass Insulation That Is Representative of Condition of Insulation Inside Of MCCT Tower AHUs

Picture 19



Damaged Fiberglass Insulation Inside AHU Servicing the MCSO

TABLE 1

Indoor Air Test Results –Middlesex County Court Complex, Cambridge, MA – October 11, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Outside (Background)	430	49	38					
17th Floor								
Accounting Office	895	75	30	4	Yes	Yes		4 supply vents, 5 plants, personal fans, missing ceiling tile
Internal Auditor's Office	720	75	30	1	Yes	Yes		Window open, 2 supply vents, dry erase board
Sheriff's Office Reception Area	703	78	31	2	No	Yes		4 plants, photocopier, humidifier, water cooler on carpet, personal fan
Warden's Office	672	73	27	1	Yes	Yes		2 plants, window open, dry erase board
Warden-Reception Area	730	73	29	1	Yes	Yes		Utility hole under sink, 5 plants, photocopier, water cooler-water on floor
Security Unit-Office	656	75	33	1	Yes	Yes	Yes	Missing ceiling tile, water damage-leak under sink, hole in wall
Lobby	575	75	31	3	No	Yes		Re-occurring leaks reported around ceiling panel

* ppm = parts per million parts of air
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 2

Indoor Air Test Results –Middlesex County Court Complex, Cambridge, MA – October 11, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
17-12 Hallway								Water stained tile, water damaged rails-periodic leaks-flooding cells
Accounting Passage								Active ceiling leaks below cell blocks
Computer Office	610	75	31	0	Yes	Yes	Yes	Water stained ceiling tiles around ductwork, 1 missing ceiling tile
Sheriff's Secretary's Office	575	76	31	1	Yes	Yes	No	Window open, plant
Sheriff's Office	548	70	30	0	Yes	Yes	Yes	
20th Floor								
Isolation/ Segregation	507	66	32	0	Yes	Yes	Yes	Window open, CT-reports of leaking valve, CT covered with plywood
Medical Storage	1170	70	37	0	No		Yes	4 CT, passive door vent
Hallway Near Exit 3								4 CT
Infirmery	532	71	34	1	Yes	Yes	Yes	Window open, dry erase board, photocopier, 5 CT, 2 ceiling tiles ajar

* ppm = parts per million parts of air
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 3

Indoor Air Test Results –Middlesex County Court Complex, Cambridge, MA – October 11, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Dormitory	604	69	33	6	Yes	Yes	Yes	Window open, 9 supply vents, 1 exhaust vent, system “cycles”
20 th Rear Dormitory	507	71	32	2	Yes	Yes	Yes	Window open, temperature complaints-cold, window drafts
Dorm. Recreation Room	576	73	33	4	No	Yes	No	5 CT, 1 ceiling tile ajar
Officer’s Station	542	71	32	2	No	Yes	No	
New Man Unit	700	71	33	13	Yes	Yes	Yes	Exhaust over restroom/cell rear, 3 ceiling tiles ajar
Gym	530	69	30	0	Yes	Yes	Yes	Window open, restroom exhaust weak/off, reports of historic snow infiltration through windows
19th Floor								
Cafeteria	594	71	34	5	Yes	Yes	Yes	8 CT around panel
Kitchen	511	70	32	9	Yes	Yes	Yes	Window open, 1 missing ceiling tile, 1 ceiling tile ajar
Food Admin. Office	587	71	33	1	No	Yes	No	

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CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 4

Indoor Air Test Results –Middlesex County Court Complex, Cambridge, MA – October 11, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Food Prep. Area	531	71	33	0	Yes	Yes	Yes	4 CT
Chapel	518	71	31	0	No	Yes	Yes	
Cell Block E	628	74	33	~10	Yes	Yes	Yes	
Cell Block G	583	73	31	~15	Yes	Yes	Yes	Window open
Protective Custody (Cell Block H)	522	71	30	~14	Yes	Yes	Yes	Window open
Cell Block F	543	71	31	~15	Yes	Yes	Yes	
18th Floor								
Laundry	480	73	31	0	Yes	Yes	Yes	Window open
Councilor's Office	610	74	30	3	Yes	Yes	Yes	Window open, 2 plants, photocopier, 6 missing ceiling tiles, 12 ceiling tiles ajar
Library	740	71	36	3	No	Yes	Yes	5 ceiling tiles ajar, photocopier, utility holes

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CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 5

Indoor Air Test Results –Middlesex County Court Complex, Cambridge, MA – October 11, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Max Unit	482	74	30	0	Yes	Yes	Yes	Fresh paint-odors
Cell Block A	497	73	29	~15	Yes	Yes	Yes	Window open
Cell Block C	580	72	29	~20	Yes	Yes	Yes	Window open
Cell Block D	500	72	29	~20	Yes	Yes	Yes	Window open, cell exhaust off
Cell Block B	468	69	29	~15	Yes	Yes	Yes	Window open
Officer's Station	590	71	32	4	Yes	Yes	Yes	Missing diffuser
Dormitory	506	72	30	~10	Yes	Yes	Yes	Air diffusers blocked with tissue paper
Shower Area							Yes	4 out of 6 exhaust vents on
Hallway	570	74	29	~60	No	Yes	Yes	

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Comfort Guidelines

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> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 6

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
4-13	495	77	25	0	No	Yes	Yes	2 plants, spray duster-100% diflouroethane
Library Breakroom/ Restroom	533	75	28	0	No	No	No	Recyclables in bag
Library Journal Room	518	76	27	0	No	Yes	No	
4-15	515	75	27	0	No	Yes	Yes	Accumulated items
Library	704	77	30	~6	No	Yes	Yes	Carpet, 2 photocopiers
4-14 Library Office Area	517	77	27	0	No	Yes	Yes	Photocopier
4-20	518	78	27	0	No		Yes	
Library Mezzanine	498	79	28	0	No	Yes	Yes	Stained carpet, old books, boxes of old newspapers
6th Floor								
6-B	443	75	16	1	No	Yes	Yes	
Probation East	432	74	17	3	No	Yes	Yes	

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CT = water-damaged ceiling tiles

Comfort Guidelines

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600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 7

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Probation Center	455	74	17	3	No	Yes	Yes	
Probation West	461	74	17	1	No	Yes	Yes	Photocopier
6-48	466	75	21	1	No	Yes	Yes	Door open
6-48a	472	74	18	1	No	Yes	Yes	Door open
Court Officer	440	72	19	1	No	Yes	Yes	
Judge's Lobby	443	73	20	1	No	Yes	Yes	Door open
Lobby 6	446	73	17	6	No	Yes	Yes	
Clerk's Office	568	74	27	1	No	Yes	Yes	Plant, chalk dust, health complaints
Court Reporter	517	74	27	1	No	Yes	Yes	
Probation Office	513	75	26	~4	No	Yes	Yes	Personal fans, plants
Court Room 6-A	492	75	27	0	No	Yes		

* ppm = parts per million parts of air
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 8

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
6-9 (storeroom)								Cigarette butts in coffee cup
Judge's Lobby	516	75	28	0	No	Yes	Yes	Carpet
Clerk's Office	508	75	28	0	No	Yes	Yes	Tobacco smoke odors
6-70 Court Officers	517	75	27	1	No	Yes	Yes	Scented candle, tobacco smoke odors
6-68	519	75	27	1	No	Yes	Yes	Recycling in cardboard boxes, tobacco smoke odors
Jury Room	509	75	28	0	No	Yes	Yes	Scented candle
Court Room 6-B	515	75	27	7	No	Yes	Yes	Carpet
7th Floor								
7-42	550	74	28	0	No	Yes		CT, carpet
Chief Court Officer	508	74	29	1	No	Yes	No	Carpet
7-37 Asst. Chief Court Officer	565	74	29	1	No	Yes	No	Carpet, dry erase board cleaner

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CT = water-damaged ceiling tiles

Comfort Guidelines

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600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 9

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
7-A Clerk	525	76	26	0	No	Yes	Yes	
7-A Judge's Lobby	545	75	26	1	No	Yes	Yes	Carpet
7-A Court Room	544	76	27	1	No	Yes	Yes	Exhaust behind judge's bench, carpet
7-1 Court Officers	494	76	26	0	No	Yes	Yes	
7-02 Jury Room	508	75	26	0	No	Yes	Yes	
7-08 Jury Room	495	76	26	0	No	Yes	Yes	Restroom
8th Floor								
8-B Courtroom	596	74	29	0	No	Yes	Yes	~40 occupants gone <5 min.
8-27	732	72	29	3	No	Yes	Yes	
8-B Lock-up	591	75	30	0	No	Yes	Yes	
8-A Courtroom	547	74	30	2	No	Yes		Carpet, dust odors

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CT = water-damaged ceiling tiles

Comfort Guidelines

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600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 10

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
8-A Court Reporter	494	73	29	0	No	Yes	Yes	
8-02 Clerk's Office	509	73	28	0	No	Yes	Yes	
8-A Judge's Lobby	534	73	29	0	No	Yes	Yes	Carpet
8-56 Court Officers	518	73	28	1	No	Yes	Yes	
8-54	513	72	28	1	No	Yes	Yes	
8-48	585	72	29	6	No	Yes	Yes	Restroom
9th Floor								
9-B Courtroom	600	73	30	22	No	Yes	Yes	
9-23 Jury Room	528	71	30	14	No	Yes	Yes	
9-31 Judge's Lobby	547	72	29	1	No	Yes	Yes	Door open
9-25	569	72	29	2	No	Yes	Yes	

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CT = water-damaged ceiling tiles

Comfort Guidelines

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> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 11

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
9-A Courtroom	489	74	28	0	No	Yes	Yes	Exhaust behind judge's bench, carpet
9-A Judge's Lobby	496	72	27	0	No	Yes	Yes	
9-A Clerk's Office	477	72	27	0	No	Yes	Yes	
9-A 2 nd Clerk	477	71	27	0	No	Yes	Yes	
9-9/9-08 Jury Room	473	72	27	0	No	Yes	Yes	2 CT
9-02	540	72	29	0	No	Yes	Yes	Restroom, water damage around hallway window
9-A Court Officer	539	72	29	0	No	Yes	Yes	Air freshener odor
9-B Court Reporter	518	72	30	1	No	Yes	Yes	Plant, personal fan
9-B Clerk's Office	491	71	29	0	No	Yes	Yes	
10th Floor								
10-B Courtroom	530	74	30	0	No	Yes	Yes	

* ppm = parts per million parts of air
CT = water-damaged ceiling tiles

Comfort Guidelines

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600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 12

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
10-34	540	73	29	0	No	Yes	Yes	
Judge's Lobby	513	73	29	0	No	Yes	Yes	
Jury Room	526	73	28	1	No	Yes	Yes	Lighting complaints
10-A Courtroom	492	74	28	0	No	Yes	Yes	Carpet
Judge's Lobby	532	75	29	1	No	Yes	Yes	Carpet, plant, restroom
Clerk's Office	521	75	29	0	No	Yes		4 plants, personal fan
Stenographer's Office	531	75	29	1	No	Yes	Yes	Plant, health complaints
2 nd Clerk's Office	506	75	28	0	No	Yes	Yes	2 plants
9-42	597	73	28	0	No	Yes	Yes	Photocopier, plant
9-43	574	72	29	1	No	Yes		Personal heater & fan
9-37	579	75	30	1	No		Yes	Personal heater, accumulated items

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CT = water-damaged ceiling tiles

Comfort Guidelines

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> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 13

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Women's Restroom							Yes	Passive door vent, CT
14th Floor								
14-12 Courtroom 4	579	73	32	5	No	Yes	Yes	Complaints of kitchen odors (from 15 th fl), carpet
14-11 Courtroom 5	604	73	30	16	No	Yes	Yes	Carpet, door open
14-04 Judge's Chamber	544	73	30	0	No	Yes	Yes	Carpet, door open
14-9 Conference Room	590	73	30	0	No	Yes	Yes	
14-15	569	72	30	0	No	Yes	Yes	Carpet, photocopier
Probation Officer	613	73	30	1	No	Yes	Yes	Carpet, personal fan, health complaints
Kelly Office	607	74	31	1	No	Yes	No	Carpet, plant
15th Floor								
Kitchen	632	71	32	0	No		Yes	

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 CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
 600 - 800 ppm = acceptable
 > 800 ppm = indicative of ventilation problems
 Temperature - 70 - 78 °F
 Relative Humidity - 40 - 60%

TABLE 14

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
15-54 Adult Probation	587	74	31	6	No	Yes	Yes	Photocopier, water cooler on carpet, personal fans (~6), chalk dust
15-64 Probation Office	586	74	31	0	No	Yes	No	Personal fans-on, supply off
15-61 Chief Probation Officer	604	72	30	0	No	Yes	No	Personal fan, carpet, restroom-exhaust on
15-56	563	72	30	0	No	Yes	No	Personal fan-on
15-44 Computer Room	752	72	31	2	No	Yes	No	Supply off, 2 plants, 2 personal fans, cleaning products
15-40	524	70	30	0	No	Yes	No	Supply off, carpet, personal fan
16th Floor								
Press Room	527	71	30	0	No	Yes	Yes	7 CT
Hearing Room	473	73	30	0	No	Yes	Yes	Box storage, 6 missing ceiling tiles
12th Floor								
12-B	607	73	30	~24	No	Yes		Carpet

* ppm = parts per million parts of air
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 15**Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000**

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Judge's Lobby	517	73	30	0	No	Yes	Yes	
Court Reporter	499	72	29	0	No	Yes	Yes	Recycling in paper bag, accumulated items
Clerk's Office	506	73	30	0	No	Yes	Yes	Castrol™ super cleaner, personal heater- on
2 nd Clerk's Office	521	71	30	0	No	Yes	Yes	
12-27	530	71	29	0	No	Yes	Yes	
12-28 Jury Room	496	70	30	0	No	Yes	Yes	Coffee odor
12-34	522	70	30	0	No	Yes	Yes	
12-A Courtroom	629	72	32	14	No	Yes	Yes	
12-48	580	71	29	0	No	Yes	Yes	
12-56	580	71	29	0	No	Yes	Yes	
12-3	624	72	31	2	No	Yes	Yes	

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CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 16

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
12 – Lobby Area	626	73	30	3	No	No	No	
11th Floor								
11-B Courtroom	515	71	28	0	No	Yes	Yes	
Sullivan	550	72	30	1	No	Yes	Yes	
Bellusci	560	72	30	1	No	Yes	Yes	
Jury Room	516	71	29	0	No	Yes	Yes	
11-A Courtroom	552	73	31	1	No	Yes	Yes	
11-A Judge's Chambers	555	73	29	3	No	Yes	Yes	Carpet, 2 plants
11-53	648	74	30	1	No	Yes	Yes	
Court Reporter's Room	554	74	30	1	No	Yes	Yes	Personal heater, ~15 plants
11-1 Court Officers	502	73	29	0	No	Yes	Yes	

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CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 17

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
11-08 Jury Room	501	73	29	0	No	Yes	Yes	
13th Floor								
13-01	533	72	29	0	No	Yes	Yes	Personal fan, carpet, restroom
Office of Roanne Sragow	524	72	30	0	No	Yes	Yes	Carpet
13-45	512	71	30	0	No	Yes	Yes	Carpet
L 1302	527	71	30	0	No	Yes	Yes	Personal fan, , carpet, air purifier-on
Courtroom B	747	72	30	~50	No	Yes		Carpet
13-27	616	72	30	1	No	Yes	Yes	Personal fan, photocopier, accumulated items
13-28	590	72	30	2	No	Yes	Yes	Personal fans, plant
13-21	695	72	30	2	No	Yes	Yes	2 plants, vase of flowers, 2 restrooms
13-20 (Cells)	840	74	32	3	No	No	Yes	

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Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 18

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Appellate Court	729	74	30	13	No	Yes		Carpet
13-47 Reception Area	585	73	30	1	No	Yes	Yes	Carpet, water cooler on carpet, photocopier under supply vent
1-1342	625	73	30	0	No	Yes	Yes	Carpet, restroom
13-5	521	73	30	0	No	Yes	Yes	Carpet, personal fans, restroom
5th Floor								
5-01	445	77	16	3	No	Yes	Yes	Health complaints, photocopier/office equipment in work area
Community Corrections CTR	461	77	18	4	No	Yes	Yes	
Lab	502	77	17	1	No	Yes	Yes	Urine sampling machine, strong urine odors, local exhaust, door open
Classroom	496	77	18	0	No	Yes	Yes	Reportedly up to 20+ occupants at times
Clinical Team	472	77	18	1	No	Yes	No	

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Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 19

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 20, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Reception Area	473	77	16	1	No	No	No	Temperature complaints-heat

Comfort Guidelines

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 600 - 800 ppm = acceptable
 > 800 ppm = indicative of ventilation problems
 Temperature - 70 - 78 °F
 Relative Humidity - 40 - 60%

TABLE 20

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 31, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
2nd Floor								
Clerk of Courts- Main Desk	631	76	33	1	No	Yes	Yes	
1-34	598	76	32	1	No	Yes	Yes	Door open
Clerk's Office C1011	739	76	32	11	No	Yes	Yes	
Superior Court Docket	594	76	31	15	No	Yes	Yes	21 computers, door open
Criminal Court Docket	578	76	32	5	No	Yes	Yes	Door open
L 36 Reception Area	701	75	32	2	No	Yes	Yes	
L 36Q	709	75	32	1	No	Yes	Yes	
L 36U-Outside Office	915	76	33	2	No	Yes	Yes	Photocopier odor
L 36-Waiting Room	683	77	31	0	No	Yes	Yes	
L 11	664	74	31	3	No	Yes	Yes	Door open

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Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 21

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 31, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
L 11-Chief Probation	651	74	30	0	No	Yes	Yes	Door open
L 14	706	75	32	0	No	Yes	Yes	
3-22	564	76	30	0	No	Yes	Yes	Door open
Step Early Intervention-Kelly Office	604	75	30	2	No	Yes	Yes	Door open
Step Early Intervention-Conference Room	591	75	31	0	No	Yes	Yes	Door open
Cafeteria	571	76	31	3	No	Yes	Yes	Plants, door open
State Police	635	74	31	3	No	Yes	Yes	Water cooler, door open
DA's Office-Lobby	636	76	32	1	No	Yes	Yes	Tobacco smoke odor, door open
DA's Office-Main Desk	654	74	32	2	No	Yes	Yes	Door open
DA's Office-Mailboxes	578	74	32	1	No	Yes	Yes	

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CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 22

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 31, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
DA's Office- Outside 2-19	562	74	32	1	No	Yes	Yes	
DA's Office- Outside Law Library	640	75	32	2	No	Yes	Yes	
DA's Office- Outside Women's Restroom	663	76	33	4	No	Yes	Yes	
1st Floor								
Day Care	560	72	32	3	No	Yes	Yes	
Darryl Smith's Office	658	72	33	1	No	Yes	Yes	Door open
Judge Sragow's Chambers	774	73	34	3	No	Yes	Yes	Door open
L-70	634	75	37	3	No	Yes	Yes	Door open
L-71								
Main Lobby	578	73	31	10+	No	Yes	Yes	

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CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
 600 - 800 ppm = acceptable
 > 800 ppm = indicative of ventilation problems
 Temperature - 70 - 78 °F
 Relative Humidity - 40 - 60%

TABLE 23

Indoor Air Test Results – Middlesex County Court Complex, Cambridge, MA – October 31, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
L-51	586	74	33	0	No	Yes	Yes	
3rd Floor								
3-33	571	75	33	8	No	Yes	Yes	Door open
Juvenile Court	488	73	31	1	No	Yes	Yes	Efflorescence, mold growth
3 rd Floor Lobby	622	72	33	10	No	Yes	Yes	
Clerk Magistrate's Office	555	75	33	0	No	Yes	Yes	Door open
Assistant Clerk Magistrate's Office	651	76	33	1	No	Yes	Yes	Door open
Juvenile Judge's Lobby	617	76	30	0	No	Yes	Yes	
Juvenile Lobby-Reception	572	75	32	1	No	Yes	Yes	Door open
Juvenile Lobby-	563	78	31	0	No	Yes	Yes	

* ppm = parts per million parts of air
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

Indoor Air Test Results

TABLE 24
Middlesex County Courthouse Tower
Elevator Rooms and Adjacent Areas

January 25, 2001

Area	Carbon Dioxide * ppm	Carbon Monoxide * ppm	TVOCs * ppm	Temp °F	Relative Humidity %	Ultrafine Particles (thousand particles/cc)
Outdoors	498	1	0.5	40	18	15.4
subbasement Room ELEVATOR 2	458	Non Detectable	0.5	68	15	24.8
Subbasement machine room subbasement	433	Non Detectable	0.5	69	16	29.7
Room Elevator 11	498	Non Detectable	0.5	72	16	16.6
Outside elevator 11 room	523	Non Detectable	0.5	71	17	14.8
Room Elevator 1	561	1	0.6	74	17	12.4
17 th floor Top of stairwell	631	Non Detectable	0.9	76	18	11.6
room elevators 4,5,7,8	542	1	0.7	79	16	16

*** ppm = parts per million parts of air****Comfort Guidelines**

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

Indicators of Elevated Levels of Indoor Air Pollutants

TVOC (Total Volatile Organic Compounds)- ≤ measured outdoor measured concentration ppm

Carbon Monoxide- ≤ measured outdoor concentration ppm

Ultrafine Particles ≤ measured outdoor concentration (thousand particles/cubic centimeter)

TABLE 25**Indoor Air Test Results****Middlesex County Courthouse Tower
Elevator Rooms and Adjacent Areas****January 25, 2001**

Area	Carbon Dioxide * ppm	Carbon Monoxide * ppm	TVOCs * ppm	Temp °F	Relative Humidity %	Ultrafine Particles (thousand particles/cc)
outside room elevators 4,5,7,8	513	1	0.5	79	15	17.1
Room elevators 6, 9	598	1	0.5	76	21	14.8
Room elevators 10, 12	532	4	0.5	73	16	21.8
Outside Room elevators 10, 12	431	Non Detectable	0.5	42	20	14
Room elevator 3	592	1	0.5	77	33	22.4
Outside elevators 1 st floor	550	Non Detectable	0.3	77	28	19.6
Interior elevator car 6 ^a	1110	1	0.5	76	22	12.6
Interior car 9 ^a	1074	1	0.5	77	17	12.4

*** ppm = parts per million parts of air****Comfort Guidelines**

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature - 70 - 78 °F

Relative Humidity - 40 - 60%

Indicators of Elevated Levels of Indoor Air Pollutants

TVOC (Total Volatile Organic Compounds)- ≤ measured outdoor measured concentration ppm

Carbon Monoxide- ≤ measured outdoor concentration ppm

Ultrafine Particles ≤ measured outdoor concentration (thousand particles/cubic centimeter)

TABLE 26
Examination of Interior of Air Handling Units on Floors 7 through 14
January 26, 2001

Air Handling Room	Air Handling Unit #	Condition Of Duct Insulation	Condition Of Filter	Comment
14-38	40		Pleated Filters	
14-49	39	Inaccessible	Inaccessible	
13-7	35	Abraded Fiberglass	Pleated Filter	
13-10	36	Abraded Fiberglass	Pleated Filter	Spaces Around Filter Intake Duct Door Open
12-47	32	Inaccessible	Inaccessible	
12-26	31	Inaccessible	Inaccessible	
11-12	26		Pleated Filter	
11-14	27			Louver Closed
11-14	25		Pleated Filter	
10-47	22		Pleated Filter	Spaces Around Filter
10-36	21		Pleated Filter	Spaces Around Filter
9-12	20	Abraded Fiberglass	Pleated Filter	
9-12	18		Pleated Filter	
9-14	19	Abraded Fiberglass	Pleated Filter	
9-14	17		Pleated Filter	
8-47	14		Pleated Filter	
8-30	13		Pleated Filter	
7-12	10		Pleated Filter	
7-12	12	Abraded Fiberglass	Pleated Filter	
7-14	9	Abraded Fiberglass	Pleated Filter	
7-14	11		Pleated filter	